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FIG. 1

| | | |
|----------|---|--|
| ALLOY a1 | LOW R ALLOY | 23.6Nd—6Pr—0.3Dy—1.1B—0.05Cu—0.2Al—bal.Fe(wt. %) |
| ALLOY a2 | LOW R ALLOY CONTAINING Zr | 23.6Nd—6Pr—0.3Dy—1.1B—0.05Cu—0.2Al—0.32Zr—bal.Fe(wt. %) |
| ALLOY a3 | LOW R ALLOY CONTAINING Zr | 15.7Nd—6Pr—8.1Dy—1.1B—0.05Cu—0.2Al—0.15Zr—bal.Fe(wt. %) |
| ALLOY a4 | LOW R ALLOY CONTAINING Zr | 23.9Nd—6Pr—1.1B—0.05Cu—0.2Al—0.15Zr—bal.Fe(wt. %) |
| ALLOY a5 | LOW R ALLOY CONTAINING Zr (WITH HIGH Al) | 23.6Nd—6Pr—0.3Dy—1.1B—0.05Cu—0.42Al—0.12Zr—bal.Fe(wt. %) |
| ALLOY a6 | LOW R ALLOY CONTAINING Zr (WITHOUT Al) | 23.6Nd—6Pr—0.3Dy—1.1B—0.05Cu—0.12Zr—bal.Fe(wt. %) |
| ALLOY a7 | LOW R ALLOY CONTAINING Zr | 27.9Nd—0.1Dy—1.1B—0.03Cu—0.05Al—0.08Zr—bal.Fe(wt. %) |
| ALLOY a8 | LOW R ALLOY CONTAINING Zr | 23.7Nd—6Pr—0.2Dy—1.6B—0.3Cu—0.25Al—0.3Zr—bal.Fe(wt. %) |
| ALLOY b1 | HIGH R ALLOY (WITHOUT B) | 40.6Nd—0.05Cu—5Co—0.2Al—bal.Fe(wt. %) |
| ALLOY b2 | HIGH R ALLOY CONTAINING Zr (WITH B) | 40.6Nd—0.5B—0.05Cu—5Co—0.2Al—3.1Zr—bal.Fe(wt. %) |
| ALLOY b3 | HIGH R ALLOY (WITHOUT B AND Al) | 40.6Nd—0.05Cu—5Co—bal.Fe(wt. %) |
| ALLOY b4 | HIGH R ALLOY (WITHOUT B) | 35.1Nd—0.03Cu—2Co—0.05Al—bal.Fe(wt. %) |
| ALLOY b5 | HIGH R ALLOY (WITHOUT B) | 40.6Nd—0.3Cu—20Co—0.25Al—bal.Fe(wt. %) |

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FIG. 2

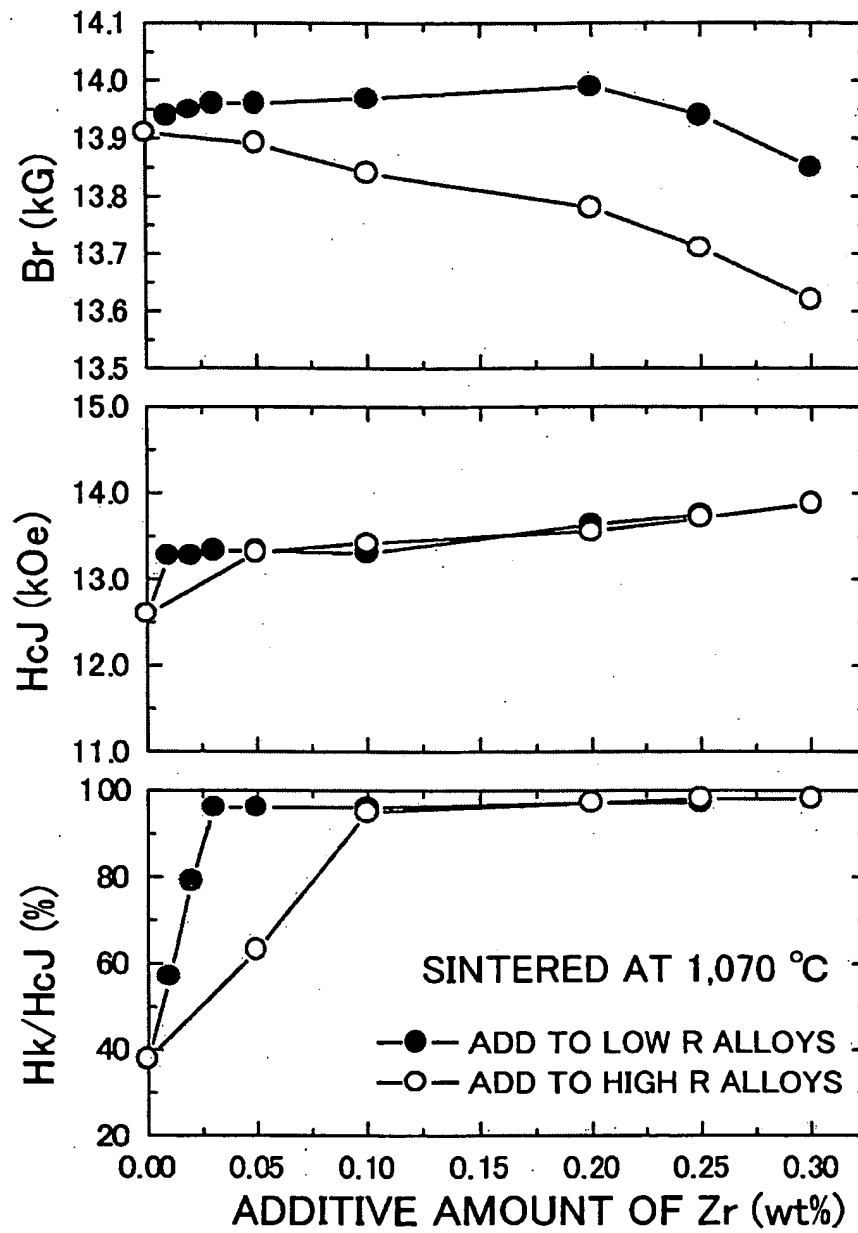
| No. | COMPOSITIONS OF SINTERED BODIES(wt. %) | AMOUNT OF OXYGEN (ppm) | LOW R ALLOYS | HIGH R ALLOYS | SINTERING TEMPERA- TURE | Br (kg) | HcJ (kOe) | Hk/HcJ (%) | Br+0.1x HcJ | CV VALUE |
|-----|--|---------------------------------|-----------------|------------------|-------------------------------|------------|--------------|---------------|----------------|-------------|
| 1 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co | 1210 | ALLOY a1 | ALLOY b1 | 1070°C | 13.91 | 12.59 | 38 | 15.17 | - |
| 2 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.01Zr | 1290 | | | | 13.94 | 13.28 | 57 | 15.27 | 68 |
| 3 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.02Zr | 1160 | | | | 13.95 | 13.29 | 79 | 15.28 | 70 |
| 4 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.03Zr | 1360 | | | | 13.96 | 13.34 | 96 | 15.29 | 66 |
| 5 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr | 1090 | ALLOY a1 + | ALLOY b1 | | 13.96 | 13.33 | 96 | 15.29 | 72 |
| 6 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr | 1190 | ALLOY a2 | | | 13.97 | 13.31 | 96 | 15.30 | 78 |
| 7 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.20Zr | 1110 | | | | 13.99 | 13.64 | 97 | 15.35 | 101 |
| 8 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.25Zr | 1320 | | | | 13.94 | 13.75 | 97 | 15.32 | 99 |
| 9 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.30Zr | 1240 | | | | 13.85 | 13.85 | 98 | 15.24 | 110 |
| 10 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr | 1350 | | | | 13.89 | 13.32 | 63 | 15.22 | 159 |
| 11 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr | 1400 | | ALLOY b1 + | | 13.84 | 13.43 | 95 | 15.18 | 214 |
| 12 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.20Zr | 1170 | ALLOY a1 | ALLOY b2 | | 13.78 | 13.56 | 97 | 15.14 | 257 |
| 13 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.25Zr | 1220 | | | | 13.71 | 13.71 | 98 | 15.08 | 281 |
| 14 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.30Zr | 1310 | | | | 13.62 | 13.88 | 98 | 15.01 | 275 |
| 15 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co | 1888 | ALLOY a1 | ALLOY b1 | | 13.89 | 11.44 | 54 | 15.03 | - |
| 16 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr | 1820 | ALLOY a1 + | | | 13.97 | 12.33 | 97 | 15.20 | 81 |
| 17 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.20Zr | 1920 | ALLOY a2 | ALLOY b1 | | 13.98 | 12.58 | 97 | 15.24 | 98 |
| 18 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.25Zr | 1870 | | | | 13.93 | 12.81 | 98 | 15.21 | 97 |
| 19 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr | 1800 | | ALLOY b1 + | | 13.81 | 12.39 | 96 | 15.05 | 223 |
| 20 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.20Zr | 1980 | ALLOY a1 | ALLOY b2 | | 13.75 | 12.55 | 97 | 15.01 | 263 |

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FIG. 3

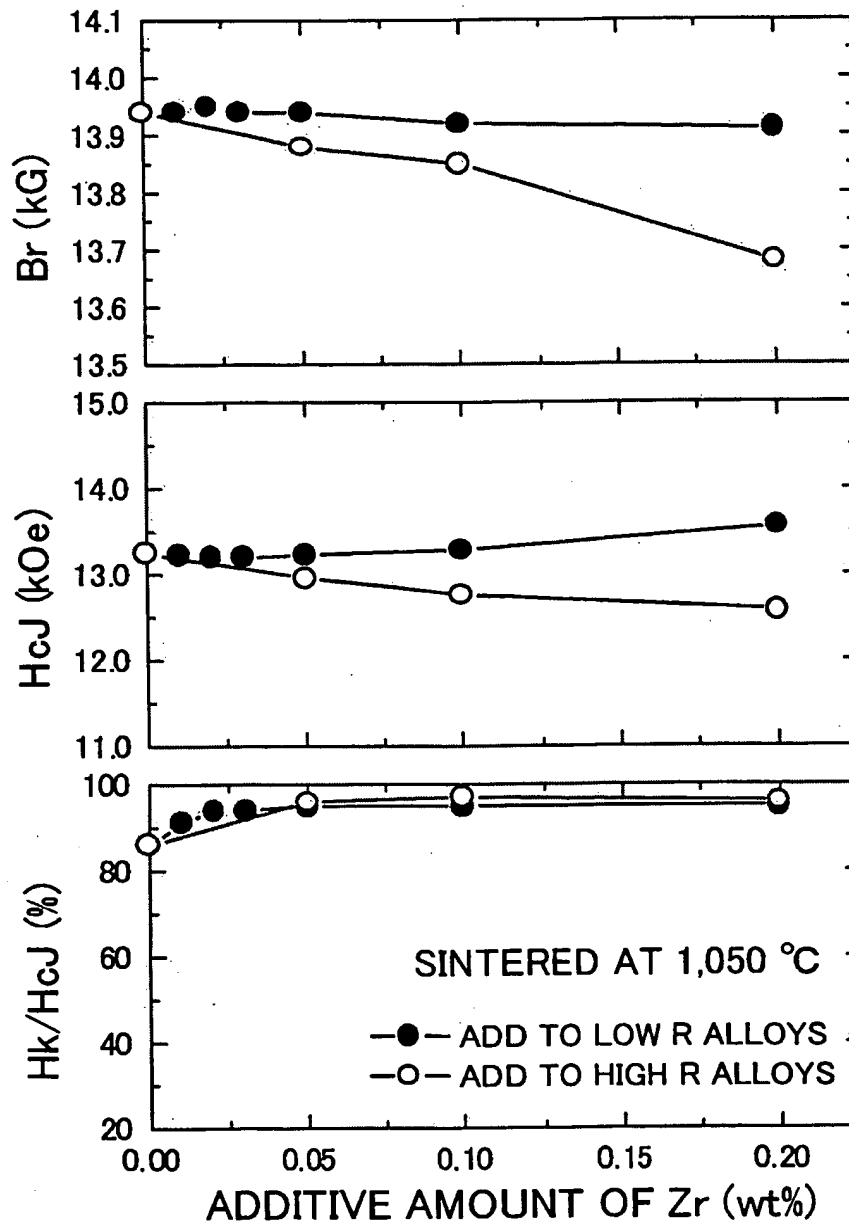
| No. | COMPOSITIONS OF SINTERED BODIES(wt. %) | AMOUNT OF OXYGEN (ppm) | LOW R ALLOYS | HIGH R ALLOYS | SINTERING TEMPERATURE | Br (kG) | HcJ (kOe) | Hk/HcJ (%) | Br+0.1x HcJ |
|-----|---|------------------------|---------------------|---------------------|-----------------------|---------|-----------|------------|-------------|
| 21 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co | 1210 | ALLOY a1 | ALLOY b1 | 1050°C | 13.94 | 13.24 | 86 | 15.26 |
| 22 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.01Zr | 1260 | | | | 13.94 | 13.23 | 91 | 15.26 |
| 23 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.02Zr | 1180 | | | | 13.95 | 13.19 | 94 | 15.27 |
| 24 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.03Zr | 1360 | ALLOY a1 + ALLOY a2 | ALLOY b1 | | 13.94 | 13.19 | 94 | 15.26 |
| 25 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr | 1110 | | | | 13.94 | 13.23 | 95 | 15.26 |
| 26 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr | 1170 | | | | 13.94 | 13.28 | 95 | 15.27 |
| 27 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.20Zr | 1200 | | | | 13.91 | 13.55 | 95 | 15.27 |
| 28 | Fe-25.0Nd-5.4Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr | 1300 | | | | 13.88 | 12.96 | 96 | 15.18 |
| 29 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.10Zr | 1370 | ALLOY a1 | ALLOY b1 + ALLOY b2 | | 13.85 | 12.76 | 97 | 15.13 |
| 30 | Fe-24.8Nd-5.5Pr-0.3Dy-1B-0.05Cu-0.2Al-0.5Co-0.20Zr | 1250 | | | | 13.68 | 12.58 | 98 | 14.94 |
| 31 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.01Al-0.5Co-0.10Zr | 1220 | | | | 14.15 | 11.20 | 95 | 15.27 |
| 32 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.03Al-0.5Co-0.10Zr | 1310 | | | | 14.14 | 12.49 | 96 | 15.39 |
| 33 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.05Al-0.5Co-0.10Zr | 1140 | ALLOY a5 + ALLOY a6 | ALLOY b1 + ALLOY b3 | | 14.13 | 12.60 | 95 | 15.39 |
| 34 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.3Al-0.5Co-0.10Zr | 1180 | | | | 13.87 | 13.27 | 97 | 15.20 |
| 35 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.4Al-0.5Co-0.10Zr | 1230 | | | | 13.61 | 13.00 | 96 | 14.91 |

FIG. 4



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FIG. 5



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FIG. 6

COMPOSITION

IMAGE

Zr

B

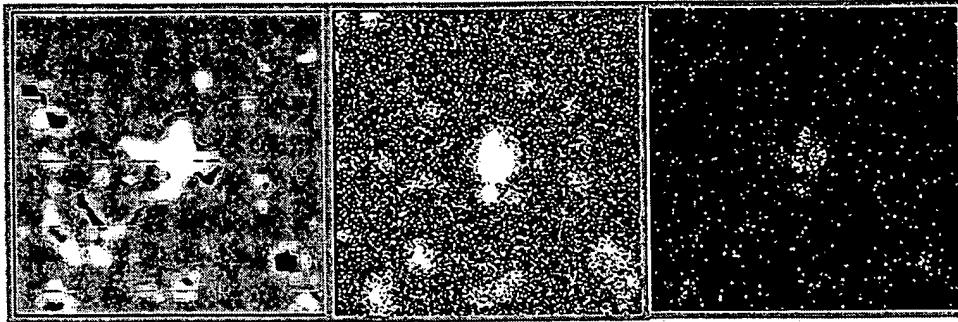


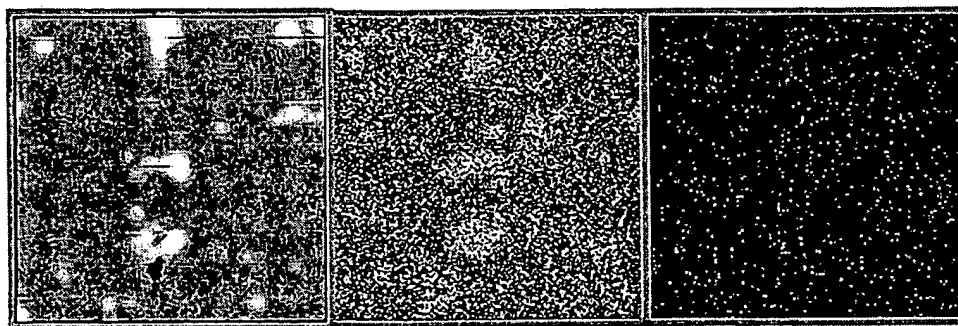
FIG. 7

COMPOSITION

IMAGE

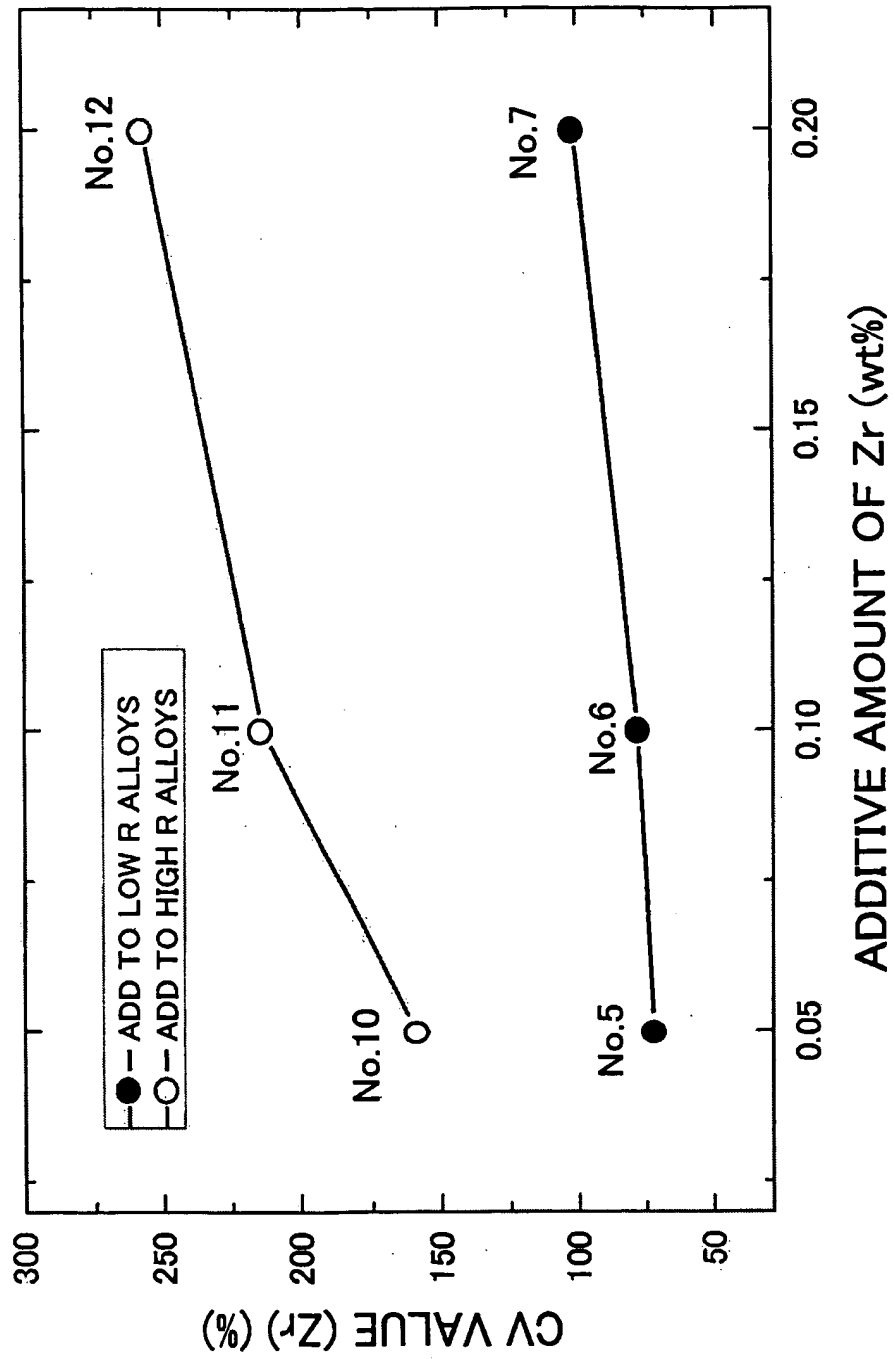
Zr

B



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FIG. 8



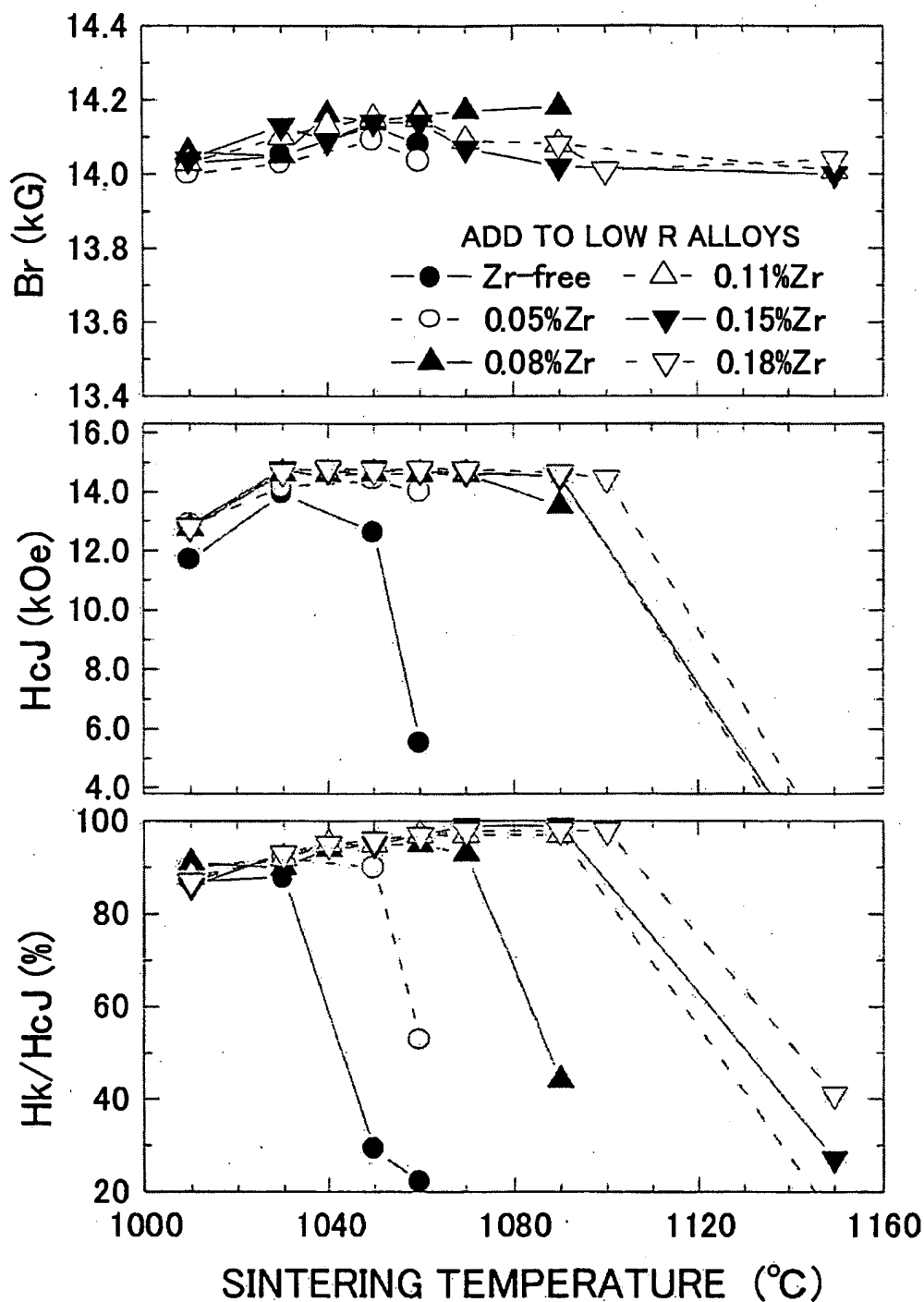
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FIG. 9

| No. | COMPOSITIONS OF SINTERED BODIES (wt. %) | AMOUNT OF OXYGEN (ppm) | SINTERING TEMPERATURE | Br (kG) | HcJ (kOe) | Hk/HcJ (%) | Br+0.1 x HcJ | CV VALUE |
|-----|--|------------------------|-----------------------|---------|-----------|------------|--------------|----------|
| 36 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co | 680 | 1010°C | 14.03 | 11.68 | 87 | 15.20 | - |
| 37 | | | 1030°C | 14.05 | 13.92 | 88 | 15.44 | - |
| 38 | | | 1050°C | 14.13 | 12.64 | 29 | 15.39 | - |
| 39 | | | 1060°C | 14.08 | 5.53 | 22 | 14.63 | - |
| 40 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.05Zr | 670 | 1010°C | 14.00 | 12.84 | 90 | 15.29 | - |
| 41 | | | 1030°C | 14.03 | 14.17 | 92 | 15.44 | - |
| 42 | | | 1050°C | 14.09 | 14.37 | 90 | 15.53 | - |
| 43 | | | 1060°C | 14.04 | 14.00 | 53 | 15.44 | - |
| 44 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.08Zr | 870 | 1010°C | 14.06 | 12.76 | 91 | 15.33 | - |
| 45 | | | 1030°C | 14.05 | 14.61 | 90 | 15.51 | - |
| 46 | | | 1040°C | 14.16 | 14.59 | 94 | 15.62 | - |
| 47 | | | 1050°C | 14.14 | 14.81 | 95 | 15.60 | - |
| 48 | | | 1060°C | 14.16 | 14.60 | 95 | 15.62 | - |
| 49 | | | 1070°C | 14.17 | 14.60 | 93 | 15.63 | - |
| 50 | | | 1090°C | 14.18 | 13.51 | 44 | 15.53 | - |
| 51 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.11Zr | 700 | 1010°C | 14.03 | 12.85 | 88 | 15.31 | 65 |
| 52 | | | 1030°C | 14.10 | 14.67 | 92 | 15.57 | 71 |
| 53 | | | 1040°C | 14.13 | 14.66 | 95 | 15.59 | 77 |
| 54 | | | 1050°C | 14.15 | 14.71 | 95 | 15.62 | 75 |
| 55 | | | 1060°C | 14.15 | 14.69 | 97 | 15.62 | 72 |
| 56 | | | 1070°C | 14.09 | 14.61 | 97 | 15.55 | 75 |
| 57 | | | 1090°C | 14.08 | 14.49 | 97 | 15.53 | 81 |
| 58 | | | 1150°C | 14.01 | 0.11 | 14 | 14.02 | 142 |
| 59 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.15Zr | 740 | 1010°C | 14.04 | 12.85 | 86 | 15.32 | 68 |
| 60 | | | 1030°C | 14.13 | 14.72 | 93 | 15.60 | 75 |
| 61 | | | 1040°C | 14.09 | 14.77 | 95 | 15.57 | 72 |
| 62 | | | 1050°C | 14.14 | 14.79 | 95 | 15.62 | 80 |
| 63 | | | 1060°C | 14.14 | 14.72 | 97 | 15.61 | 85 |
| 64 | | | 1070°C | 14.07 | 14.66 | 99 | 15.53 | 88 |
| 65 | | | 1090°C | 14.02 | 14.51 | 99 | 15.47 | 91 |
| 66 | | | 1150°C | 14.00 | 0.50 | 27 | 14.05 | 150 |
| 67 | Fe-24.9Nd-5.4Pr-0.4Dy-1B-0.05Cu-0.2Al-0.5Co-0.18Zr | 810 | 1010°C | 13.98 | 12.81 | 87 | 15.26 | - |
| 68 | | | 1030°C | 14.07 | 14.67 | 93 | 15.54 | - |
| 69 | | | 1040°C | 14.13 | 14.80 | 95 | 15.61 | - |
| 70 | | | 1050°C | 14.05 | 14.72 | 96 | 15.52 | - |
| 71 | | | 1060°C | 14.18 | 14.78 | 97 | 15.65 | - |
| 72 | | | 1070°C | 14.03 | 14.76 | 98 | 15.51 | - |
| 73 | | | 1090°C | 14.08 | 14.63 | 98 | 15.54 | - |
| 74 | | | 1100°C | 14.01 | 14.45 | 98 | 15.46 | - |
| 75 | | | 1150°C | 14.04 | 1.75 | 41 | 14.22 | - |

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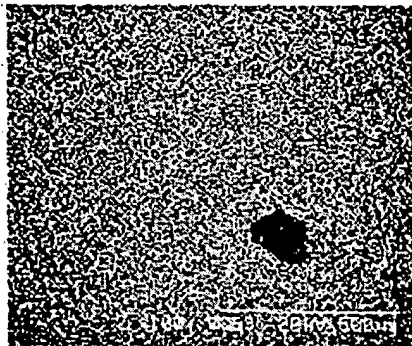
FIG. 10



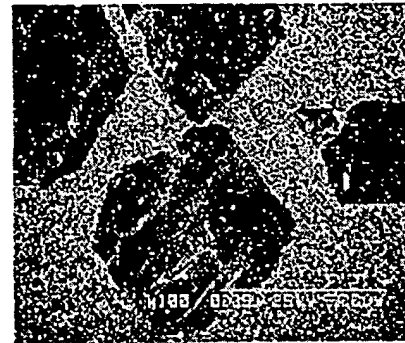
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FIG. 11

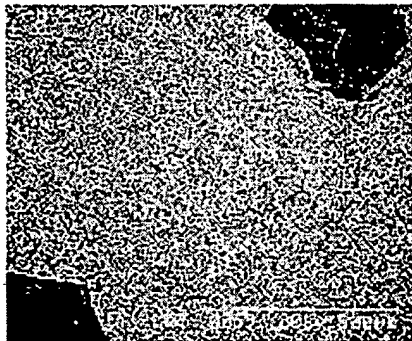
No. 37 1030°C Zr-free



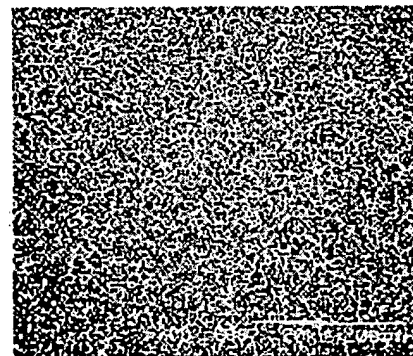
No. 39 1060°C Zr-free



No. 43 1060°C 0.05%Zr

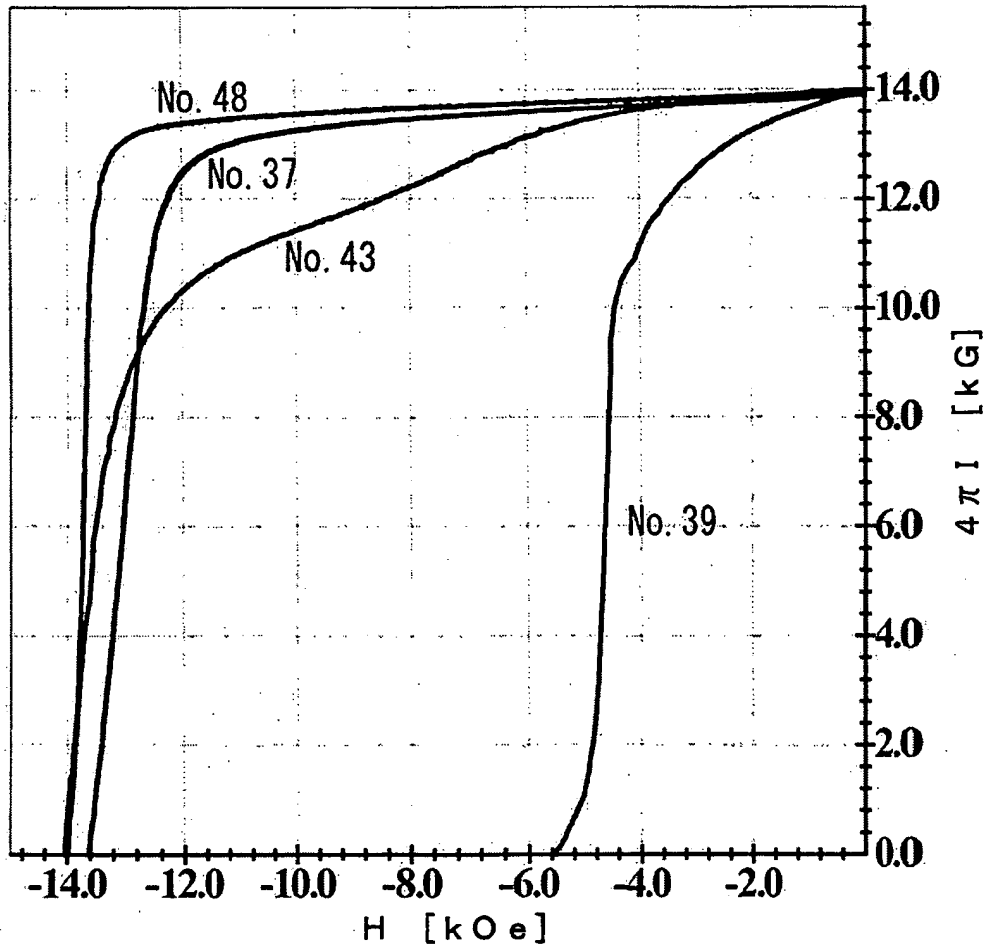


No. 48 1060°C 0.08Zr



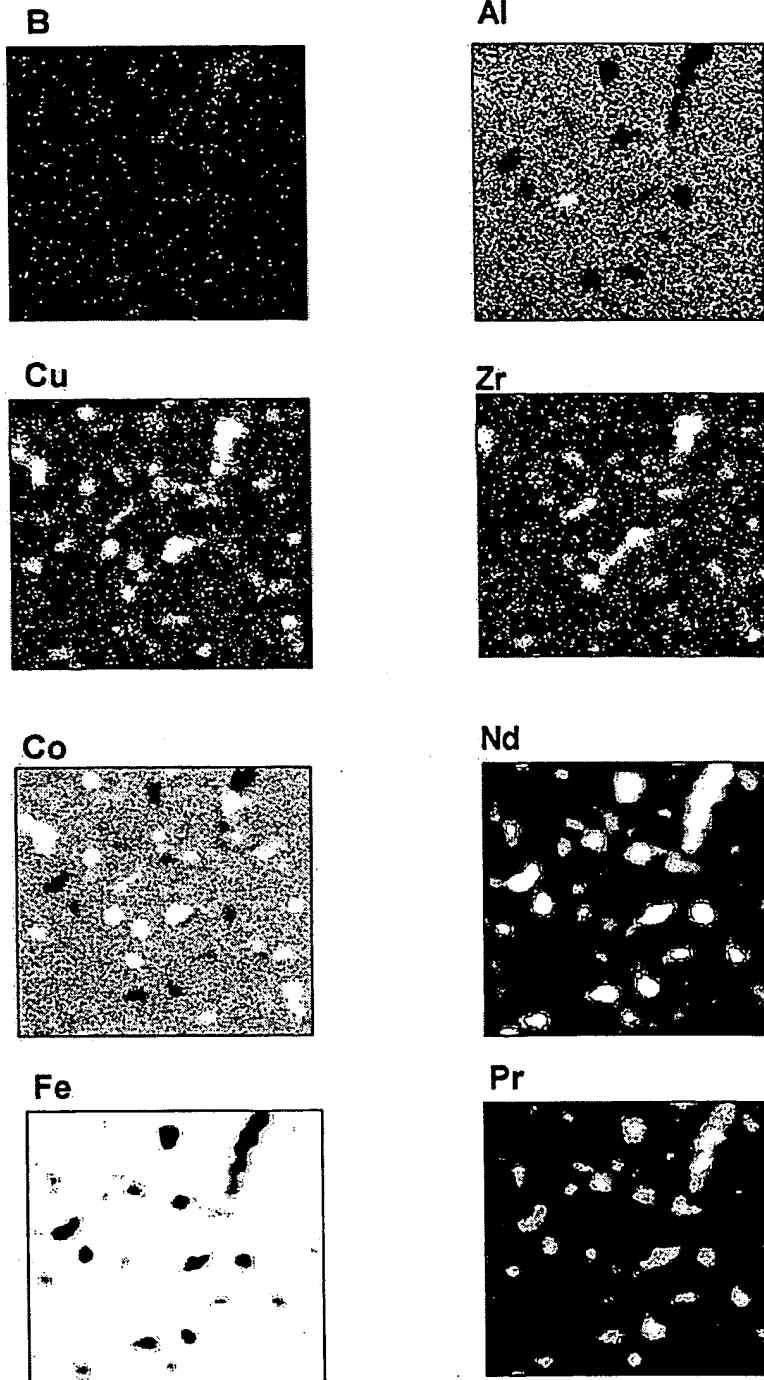
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FIG. 12



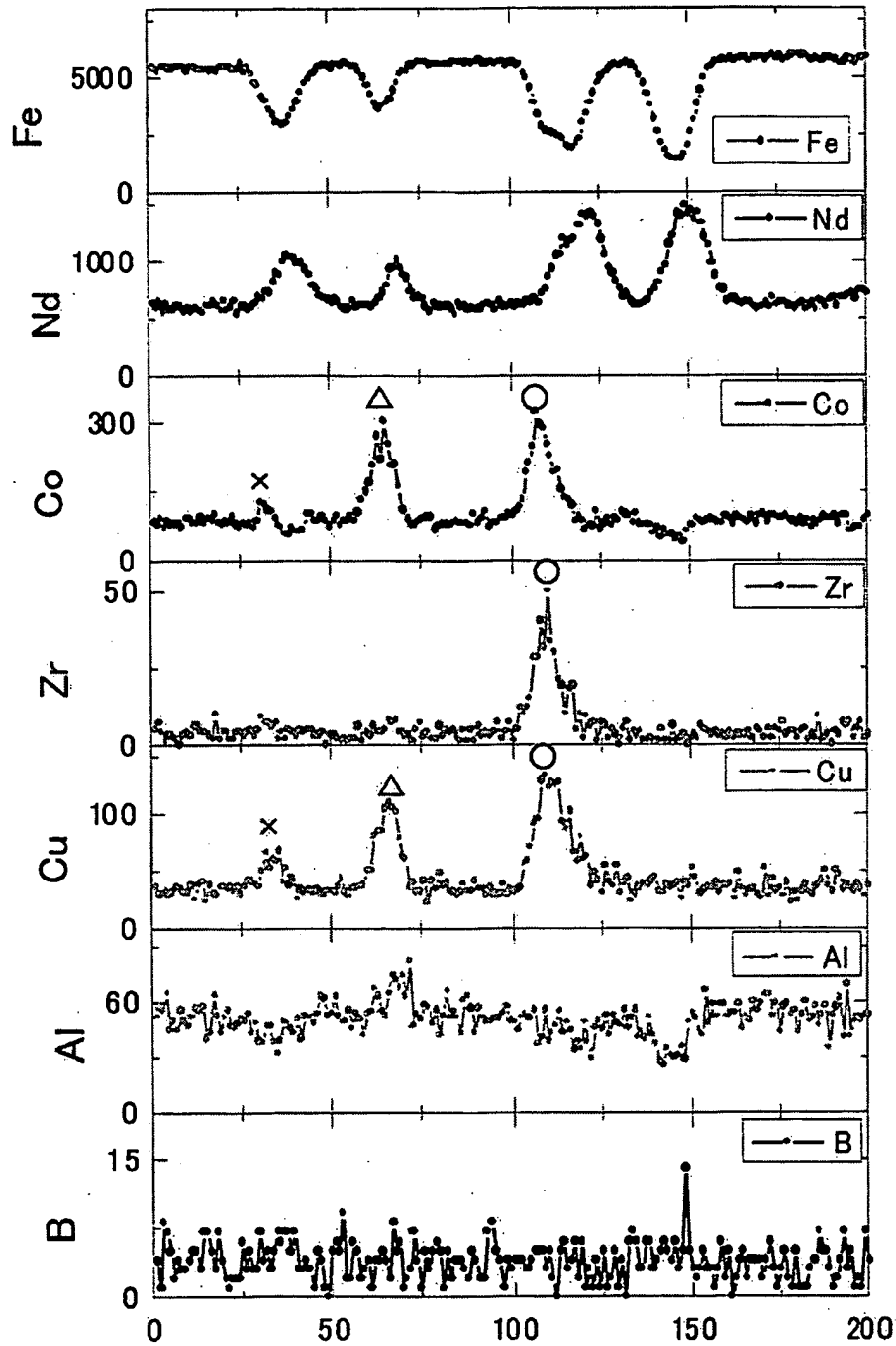
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FIG. 13



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FIG. 14



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FIG. 15

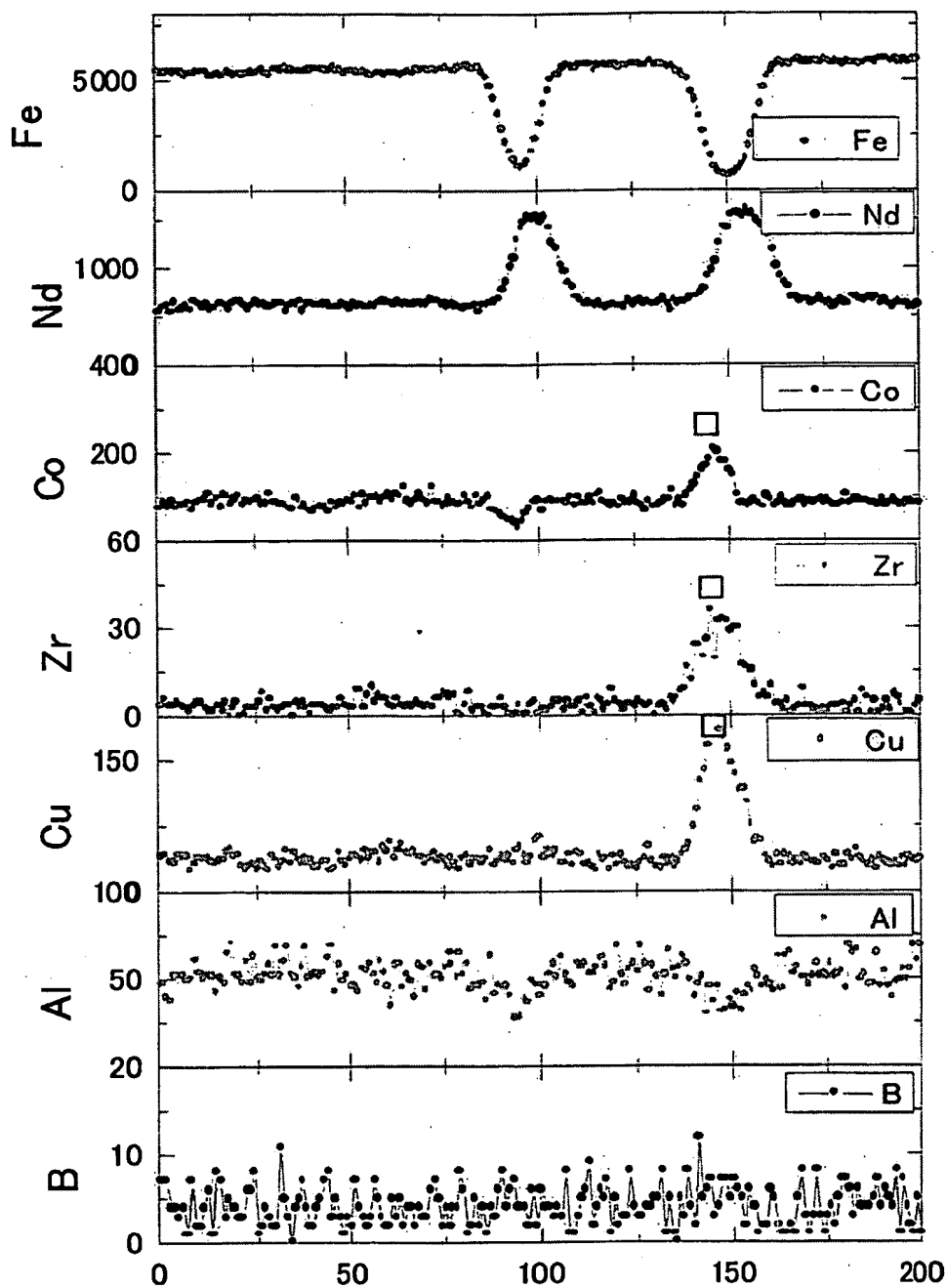
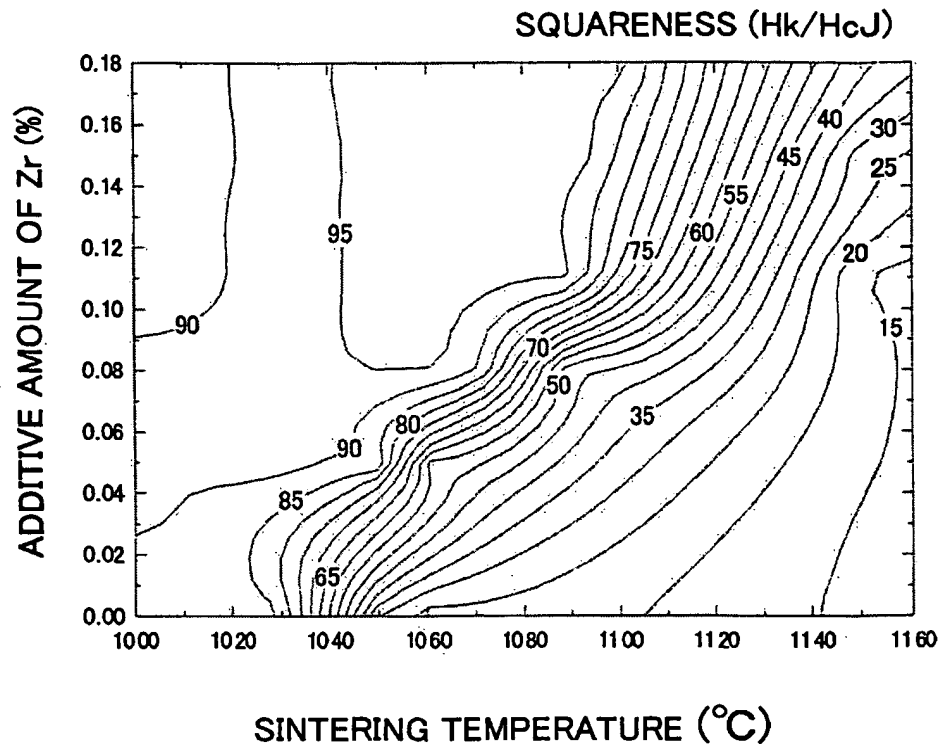


FIG. 16



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FIG. 17

| No. | COMPOSITIONS OF SINTERED BODIES(wt. %) | LOW R ALLOYS | HIGH R ALLOYS | SINTERING TEMPERA- TURE | Br (kG) | HcJ (kOe) | Hk/HcJ (%) | Br+0.1 x HcJ |
|-----|--|--------------------------------|------------------|-------------------------------|------------|--------------|---------------|-----------------|
| 76 | Fe-25.0Nd-5.3Pr-1B-0.05Cu-0.2Al-0.5Co-0.13Zr | ALLOY a4 | ALLOY b1 | 1060°C | 14.42 | 12.62 | 98 | 15.88 |
| 77 | Fe-23.2Nd-5.4Pr-2.1Dy-1B-0.05Cu-0.2Al-0.5Co-0.13Zr | ALLOY a1 + ALLOY a2 + | | 1070°C | 13.68 | 17.3 | 97 | 15.41 |
| 78 | Fe-20.6Nd-5.4Pr-4.7Dy-1B-0.05Cu-0.2Al-0.5Co-0.13Zr | ALLOY a3 | | 1090°C | 13.19 | 23.23 | 98 | 15.51 |
| 79 | Fe-19.0Nd-5.3Pr-7.2Dy-1B-0.05Cu-0.2Al-0.5Co-0.13Zr | | | | 12.37 | 30.51 | 94 | 15.42 |

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FIG. 18

| No. | COMPOSITIONS OF SINTERED BODIES(wt. %) | AMOUNT OF OXYGEN (ppm) | LOW R ALLOYS | HIGH R ALLOYS | SINTERING TEMPERA- TURE | Br (kg) | HcJ (kOe) | Hk/HcJ (%) | Br+0.1 x HcJ | CV VALUE |
|-----|--|---------------------------------|-----------------|------------------|-------------------------------|------------|--------------|---------------|-----------------|-------------|
| 80 | Fe-28.3Nd-0.1Dy-1B-0.03Cu-0.05Al-0.2Co-0.07Zr | 720 | ALLOY a7 | ALLOY b4 | 1070°C | 14.62 | 13.1 | 98 | 15.93 | 77 |
| 81 | Fe-26.9Nd-4.8Pr-0.2Dy-1.3B-0.3Cu-0.25Al-4Co-0.24Zr | 980 | ALLOY a8 | ALLOY b5 | 1020°C | 13.88 | 15.3 | 96 | 15.41 | 98 |